Title: National Stream Summarization: Standardizing Stream-Landscape Summaries
CDI SSF Element(s): Science Project Support, Data, Information

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Abstract:

As research and management of natural resources shifts from local to regional and national scales the need for information of aquatic systems to be summarized to multiple scales is becoming more apparent. Recently, four federally funded national stream assessment efforts (i.e. USGS AGAP and NAQWA programs, EPA StreamCat, and NFHP) identified and summarized landscape information into two hydrologically and ecologically significant scales of local and network catchments for the National Hydrography Dataset Plus (NHDPlus). These efforts have revealed a significant percent of assessment funds being directed to collection and processing of data vs. the assessments themselves. Additionally, although similar data are being summarized across these efforts, each is creating their own implementation. This is inefficient, duplicative and may be producing inconsistent results.

To address these issues, USGS AGAP, USGS NAQWA, EPA StreamCat and NFHP groups along with several collaborators will test and compare their approaches and develop a common workflow (i.e. code) to accurately and efficiently summarize landscape information into local and network catchments of the NHDPlus. A face to face meeting is proposed to establish specific requirements of the summarization workflow and to facilitate the identification of key landscape variables for ecologic and hydrologic modeling efforts of our collaborating partners. To help establish and authenticate the workflow the commonly used NLCD dataset will be summarized, delivered and publicly released. In addition, we will develop a work plan to process variables of importance using the new, common workflow and to work towards developing a single, common dataset repository to store and disseminate this summarized information.

Total funding amount requested: $44,793
Total in-kind funding: $36,811

Expected Product(s) Generated:

1. USGS-EPA release of a scientific workflow (code) documenting the standardized method of attribution (local catchment summaries) and aggregation (upstream network catchment summaries) of landscape information to NHDPlus catchments. Feedback from collaborating partners will be considered in the development of the workflow. It will focus current efforts on the commonly used NHDPlusV2.1 (1:100,000) dataset yet will be developed in consideration of transferability to future stream networks such as the NHD High Resolution Dataset Plus (1:24,000).
2. List of national datasets where local and network summaries are needed in ecological and hydrologic modeling efforts of the USGS, EPA, USFWS, and other collaborating agencies.
3. USGS-EPA data release of complete local and up-stream network summaries, documented with FGDC metadata for the pilot dataset of the National Land Cover Dataset (2011).
4. Proposed work plan for collaborative efforts of summarizing and documenting (e.g. metadata development) the list of variables identified in product #2 along with variables processed in previous efforts, and for updating / processing newly developed datasets (e.g. updated NLCD). This plan will include a list of variables along with a timeline for processing the information.

B. General Public Summary

As technology advances information about the landscapes around us is becoming more readily documented and made available in digital formats. Although ample data are currently available, the raw forms of these data are not always useful for scientific research, but rather the information needs to be processed into appropriate spatial units for analyses. While studying streams, research suggests a stream and its condition can be characterized by landscape information (e.g. percent of the land with urban development vs. natural forest) by accounting for the landscape draining to a stream segment (local catchment) and the landscape upstream of the stream segment (network catchment). Currently three national efforts have independently produced similar stream summarizations to local and network catchments which is inefficient, duplicative, and may be producing inconsistent results.

We propose to form a collaborative effort to develop a common workflow that efficiently summarizes information to local and network catchments, while taking into consideration needs of data users. We will test the summarization using a commonly used land use dataset and publish the developed software and processed dataset for public consumption. A plan will be developed to process other needed data summaries through time.

C. Proposal Narrative

Scope

Several research and management activities now require information from regional or national datasets to be summarized into ecologically relevant spatial units. Past experiences in the ecologic and hydrologic communities have shown these sorts of summarizations to consume a large amount of time and limited research dollars. This limits the ability of many projects to process needed information on their own and overall reduces productivity of scientific research.

In recent years, the USGS Aquatic Gap Analysis Program (AGAP), USGS NAQWA Program, EPA Safe and Sustainable Water Resources National Program and the National Fish Habitat Partnership (NFHP) have been assessing and characterizing various aspects of the streams within the nation. These efforts have largely worked independent from one another with exception of AGAP and NFHP, which use the same data. As the efforts start to be finalized and released these groups have identified some mutual interests across projects, one of which being the need to summarize national datasets of landscape information into ecologically and hydrologically relevant spatial units of local and upstream network catchments (Wang et al. 2011), referred to here as stream summarization. Although the goal of stream summarization is similar for each project and similar data are being summarized across these efforts, each effort is creating their own implementation. This is inefficient, duplicative, and may be producing inconsistent results.

To address these issues, USGS AGAP, USGS NAQWA, EPA StreamCat and NFHP groups, along with several collaborators, will test and compare their current approaches and develop a common workflow (i.e. code) (Figure 1) to accurately and efficiently summarize landscape information into local and network catchments of the NHDPlus. A face to face meeting is proposed to establish specific requirements (referenced in Figure 1) of the summarization workflow and to facilitate the identification of key landscape variables for ecological and hydrologic modeling efforts of our collaborating partners. To help establish and authenticate the workflow the commonly used NLCD dataset will be summarized, delivered and released. In addition, we will develop a work plan to process variables of importance using the new, common workflow and to work towards developing a single, common dataset repository to store and disseminate this summarized information.

Developing a collaborative effort across existing national efforts, along with several other agencies and programs will strengthen the utility and sustainability of the proposed workflow and resulting data. With a pooled knowledgebase from cooperators specializing in ecosystem, water, fisheries, and climate we will have a more complete understanding of hydrologic and ecologic processes important to a widespread audience for the development of this workflow. In addition, incorporating computing experts from the USGS High Performance Computing will ensure cutting edge technologies and processes are included in the workflow. This will help improve efficiency of the workflow and make it more sustainable as technology advances. We also see the proposed work as an opportunity to strengthen relationships between programs and agencies having similar needs with hopes of identifying and leading to future collaborative opportunities that will further advance the field.

Although this proposal focuses on summarization of landscape information into two hydrologically and ecologically important scales the publicly released workflow will include processes that can be easily adopted within other stream research efforts. For example, the workflow can be altered to perform summarizations of information to stream buffers and hydrologic units (e.g. HUC12, HUC8). In addition, parts of the workflow may prove useful for other stream processing such as identifying specific features upstream of a given local catchment.

Technical Approach

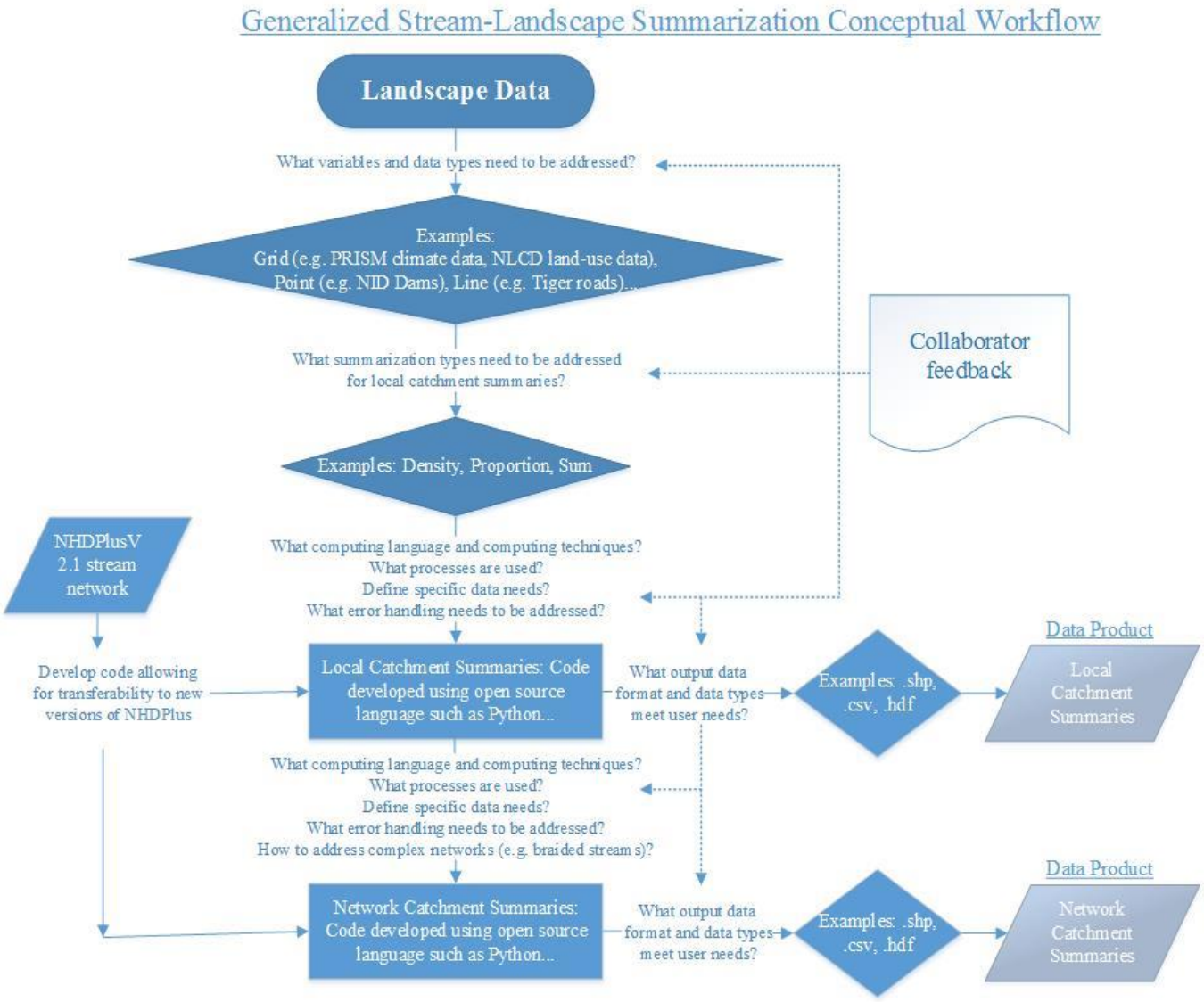

Figure 1: A generalized conceptual workflow of stream-landscape summarization, highlighting identified decision points that will need to be addressed through proposed work.

Step 1: We will evaluate existing USGS, NFHP, and EPA stream summarization workflows and techniques for computing performance, and quality of data output. First, general techniques and processes of data summarization will be discussed to determine similarities and differences in any of the existing workflows. Next, two common landscape datasets (i.e. catchment area and PRISM precipitation data) will be processed by each workflow to help determine any additional differences. Differences in data will be examined using database queries and one to one plots. If differences between datasets exist they will be further investigated in a spatial environment to help determine causality. In addition, when available summarization efforts will be compared to data provided with the NHDPlus (e.g. upstream network catchment area). To further verify values of summarized network catchments we will compare against values in the gages 2 dataset using a predefined process developed by USGS NAQWA.

Notes of similarities and differences in workflows will be captured for further discussion within the face-to-face meeting.

Step 2: Have a face to face meeting at Denver Federal Center to determine specific data needs of the user groups within USGS, EPA, and collaborating agencies.

Main goals of this meeting include:

- Get feedback on existing summarization workflows, highlighting both similarities and differences
- Based on feedback and past experiences, set guidelines for summarization workflow. See Figure 1 for expected decisions that will need to be made.
- Determine list of high priority variables for all participating collaborators
- Discuss and determine best options for code and data dissemination to make it most valuable to users and collaborators. For example, discuss appropriate data type of released summary information (e.g. shapefile vs. .hdf vs. csv)

Step 3: We will use feedback from the face to face meeting, along with expertise from USGS High Performance Computing (HPC) to help develop standardized, efficient and robust process(es) for summarizing landscape information into local and network catchments utilizing open source and parallelized computing environments when appropriate. Use existing workflow summaries to test quality of output data from the new workflow. Data comparisons will be performed in a similar manor described in Step 1.

Step 4: Process NLCD 2011 dataset using newly developed workflow. Develop metadata using the FGDC Content Standard for Digital Geospatial Metadata and begin the process of USGS and EPA data release processes.

Step 5: EPA contractor with guidance from PIs will finalize and fully document summarization code in a repository such as USGS Stash. Begin the process of USGS and EPA release processes, meeting both agency requirements for software release.

Step 6: Discuss and propose long term collaborative efforts and roles for data and code updates through time. This includes the development of plans to work towards a common data repository for storing and disseminating summarized information.

Project Experience and Collaboration

Additional details can be found in attached CVs of the PI team.

National and Regional Stream Assessment Experience

The PI team is comprised of members from three national stream assessment efforts. PIs Infante and Wieferich are core members of the National Fish Habitat Partnership (NFHP) National Inland Assessment of Streams (Wang et al. 2011; Esselman et al. 2013, Tsang et al. 2014, Daniel et al. 2015) and Aquatic Gap Analysis Program national stream fish habitat distribution modeling efforts. PIs Leibowitz and Weber have been involved in EPA's development of national maps of watershed integrity and stream condition, and were core members developing the EPA StreamCat products (Hill et al 2015).

Collaborators bring unique experiences and connections to other regional and national landscape efforts that are potential users of the stream summarization workflow. Michael Wieczoreck, from the USGS NAQWA program, will provide valuable experience and insights learned while summarizing landscape information to the NHDPlusV2.1 for his program. Jeffery Houser is a member of the USGS Upper Midwest Environmental Science Center and brings perspectives and experience from research such as water quality studies related to the Long Term Research Monitoring Program on the Upper Mississippi River. Brad Potter, the coordinator of the Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC), Abby Lynch, a Research Fisheries Biologist for the National Climate Change and Wildlife Science Center, and Roland Viger, from the USGS Water Resources National Research Program, will each act as liaison's directing us towards researchers in their respective communities that will contribute to and benefit from our work. In addition, Alan Rea is a hydrologist leading efforts on the USGS National Hydrography Dataset (NHD) and also participates in the Open Water Data Initiative (OWDI). He will contribute knowledge about the different versions of the NHD and the OWDI, along with ongoing developments of the NHDPlus High Resolution to help ensure our methods of summarization can be adopted for this upcoming product. This collaboration will provide opportunities to submit feedback towards future development of NHD products and help expose our efforts to the community of NHD users.

Stream Summarization Experience

PIs Infante and Wieferich have developed a workflow to summarize large amounts of natural and anthropogenic information to local and network catchments of the NHDPlus through work with the National Fish Habitat Partnership, and USGS AGAP (Tsang et al. 2014). In addition, these efforts were utilized in a USGS funded project forecasting climate and land-use change on fish habitat at multiple spatial scales (http://fishhabclimate.org/) where hundreds of climate variables were summarized to local and network catchments for analyses. PIs Leibowitz and Weber have been involved in the development of the StreamCat dataset (Hill et al. 2015), which contains over 160 metrics containing both natural and human-related landscape features for the 2.6 million stream catchments in the NHDPlusV2. They have used these data to develop national maps of watershed integrity and stream condition, and are working to develop similar datasets and products for NHDPlusV2 lakes.

Computer Programming and Data Management Experience

PIs Falgout and Williams core members of the USGS High Performance Computing group, specializing in scientific computing and programming. They will provide programming support and will help explore opportunities of scaling the program to run efficiently (e.g. using multiple processors) on different computing environments. PIs Wieferich and Weber have past experience with developing summarization programs, managing resulting national datasets and performing data release through their respective agencies.

Sustainability

Four active federally funded programs will be included in the development of the code to ensure it meets current and future needs of the programs and their collaborators. The collaborative effort between the existing national projects and use of the standardized methods in each will help ensure persistence, use and advances through time. Each effort has plans for future assessments, which will require newly processed information. To address this need a proposed outcome is to discuss and propose long term collaborative efforts and roles for data and code updates through time. This includes the development of plans to work towards a common data repository for storing and disseminating summarized information. Code will be released in a code repository allowing our core team and other interested parties to use the code and assist in potential troubleshooting and improvements through time.

Collaboration with the NHD program will provide opportunities to submit feedback towards future developments of the hydrography datasets and help expose our efforts to the community of NHD users.

Developing a collaborative effort across existing national efforts, along with several other agencies and programs will strengthen the utility and sustainability of the proposed workflow and resulting data. With a pooled knowledgebase from cooperators specializing in ecosystem, water, fisheries, and climate we will have a more complete understanding of hydrologic and ecologic processes important to a widespread audience for the development of this workflow. In addition, incorporating computing experts from the USGS High Performance Computing will ensure cutting edge technologies and processes are included in the workflow. This will help improve efficiency of the workflow and make it more sustainable as technology advances. We also see the proposed work as an opportunity to strengthen relationships between programs and agencies having similar needs with hopes of identifying and leading to future collaborative opportunities that will further advance the field.

Budget Justification: See accompanying spreadsheet for additional details. CDI proposal funds will be used for three main expenditures explained below.

1. EPA contractor: Funds are requested for an EPA contractor to help conduct comparisons of existing stream summarization workflows, to use the new workflow to process NLCD 2011 data, and to conduct data management and metadata development activities throughout the process.

2. Face to face meeting: Funds are requested for travel of the 9 PIs and collaborators (including the EPA contractor) that are not within the Denver-Metro area. The main goals of this meeting include:

- Get feedback on existing summarization workflows, highlighting both similarities and differences
- Based on feedback and past experiences, set guidelines for summarization workflow
- Determine list of high priority variables for all participating collaborators
- Discuss and determine best options for code and data dissemination to make it most valuable to users and collaborators. For example, discuss appropriate data type of released summary information (e.g. shapefile vs. .hdf vs. .csv)

3. Presentation of CDI project

Timeline

We anticipate the following project milestones to align with the following timeline:
March 9, 2016: Funding awarded
April 15, 2016: Face-to-Face meeting scheduled
May 31, 2016: Complete comparisons of existing workflows and resulting data
June 30, 2016: Face-to-Face meeting completed
July 31, 2016: Code prepared for NLCD summarization
September 2016: -QAQC workflow code and NLCD summaries
-Documented workflow with readme file and metadata
-Documented NLCD summaries with full FGDC metadata
-Agency review processes started for USGS and EPA release for both workflow and NLCD summaries.

D. References

Daniel, W.M., D.M. Infante, R.M. Hughes, Y. Tsang, P. Esselman, D. Wieferich, K. Herreman, A. R. Cooper, L. Wang and W. Taylor. 2014. Characterizing coal and mineral mines as a regional source of stress to stream fish assemblages. Ecological Indicators. 50:50-61. doi: 10.1111/1752-1688.12372.

Esselman, P.C., Infante, D.M., Wang, L., Cooper, A.R., Wieferich, D., Tsang, Y., Thornbrugh, D.J., Taylor, W.W., 2013. Regional fish community indicators of landscape disturbance to catchments of the conterminous United States. Ecological Indicators. 26, 163–173.

Hill, R. A., M.H. Weber, S.G. Leibowitz, A.R. Olsen, and D.J. Thornbrugh. 2015. The Stream-Catchment(StreamCat) Dataset: A Database of Watershed Metrics for the Conterminous United States. Journal of the American Water Resources Association (JAWRA) 1-9. doi: 10.1111/1752-1688.12372.

Tsang, Y. P., D. Wieferich, K. Fung, D.M. Infante, and A.R. Cooper. 2014. An approach for aggregating upstream catchment information to support research and management of fluvial systems across large landscapes. Springer Plus 3:589. doi:10.1186/2193-1801-3-589.

Wang, L. Z., D. Infante, P. Esselman, A. Cooper, D. Wu, W. Taylor, D. Beard, G. Whelan, and A. Ostroff. 2011. A hierarchical spatial framework and database for the national river fish habitat condition assessment. Fisheries 369:436-449.

E. Two page CVs for PIs

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Phone: 303-202-4594; Email: dwieferich@usgs.gov

Education

Computer Programmer/Analyst Certificate of Completion, December 2014
Lansing Community College, Lansing, MI GPA: 3.73

Master of Science: Department of Fisheries and Wildlife, December 2009
Thesis title: Investigating Beech Scale Population Dynamics and Distribution in Michigan
Michigan State University, East Lansing, MI GPA: 3.93

Bachelor of Science: Department of Fisheries and Wildlife, May 2007
Specialization: Spatial Information Processing (GIS), May 2007
Michigan State University, East Lansing, MI GPA: 3.71

Relevant Work Experience

Position: Physical Scientist GS9
Employer: U.S. Geological Survey; Core Science Analytics, Synthesis, and Libraries
Employment: August 2014 – Present
Duties: I manage data for the Aquatic GAP Analysis Program (AGAP) and National Fish Habitat Partnership (NFHP) Data System. I contributed to the development of a data workflow to assist partners in contributing data and FGDC CSDGM compliant metadata to the NFHP Data System. Through the Aquatic GAP Analysis Program I am conducting a national connectivity analysis to determine regional needs and availability of fish passage data. This analysis is intended to build a framework that can support a nationally consistent fish passage barrier dataset.

Position: GIS Analyst and Database Manager / Research Technician
Employer: Department of Fisheries and Wildlife, Michigan State University
Employment: October 2009 – August 2014

Position: Graduate Research Assistant, Beech Scale Population Dynamics and Dispersal Study
Employer: Michigan State University; Department of Fisheries and Wildlife
Employment: May 2007- October 2009

Position: Student Research Assistant and Crew Leader, Beech Bark Disease Study
Employer: Michigan State University; Departments of Entomology and Forestry
Employment: May 2005- May 2007

Position: GIS Analyst Student Internship
Employer: MSU Remote Sensing & GIS Research and Outreach Services
Employment: August 2005 – December 2005

Position: Student Laboratory/Field Assistant (Stream water quality sampling)
Employer: Michigan State University; Department of Zoology
Employment: January 2004 – October 2004

Relevant Professional Publications

First Author:

Wieferich, Daniel, Wesley M. Daniels and Dana M. Infante. 2015. Enhancing the Utility of the NHDPlus River Coverage: Characterizing Ecological River Reaches for Improved Management and Summary of Information. Fisheries 40(11): pages 562-564.

Co-Author:

Tsang, Yin-Phan, ***Daniel Wieferich***, Koulin Fang, Dana M. Infante, and Arthur R. Cooper. 2014. An approach for aggregating upstream catchment information to support research and management of fluvial systems across large landscapes. Springer Plus Volume 3(589). Doi:10.1186/2193-1801-3-589.

Daniel, Wesley M., Dana M. Infante, Robert M. Hughes, Yin-Phan Tsang, Peter C. Esselman, ***Daniel Wieferich***, Kyle Herreman, Arthur R. Cooper, Lizhu Wang, and William W. Taylor. 2014 Characterizing coal and mineral mines as a regional source of stress to stream fish assemblages. Ecological Indicators 50: 50-61.

Esselman, Peter C., Dana M. Infante, Lizhu Wang, Arthur Cooper, ***Daniel Wieferich***, Yin-Phan Tsang, Darren J. Thornbrugh, and William Taylor. 2013. Regional fish community indicators of landscape disturbance to catchments of the conterminous United States. Ecological Indicators 26: 163-173.

Relevant Presentations

Events: American Fisheries Society 145th Annual Conference August 2015
International Society of River Science 4th Biennial Symposium August 2015
Presentation Title: National Stream Fish Passage Barrier Inventory: Connecting Fragmented Data

Event: American Fisheries Society 143rd Annual Conference September 2013
Presentation Title: A web-based decision support mapper for understanding the response of fish species and stream temperature to climate change in the Great Lakes region

Event: American Fisheries Society 142nd Annual Conference (Invited Presenter) August 2012
Presentation Title: Improving Opportunities for Large-Scale Fish Habitat Conservation: Data Developed in Support of the National Fish Habitat Action Plan

Jeff T. Falgout
Computer Scientist
U.S. Geological Survey
Core Science Analytics, Synthesis, & Libraries
Applied Research Computing

Education:

1999–2000, Computer Science, University of Denver, Denver, CO

1995, B.S. Biology, Northwestern State University of Louisiana, Natchitoches, LA

Professional Experience:

November 2015 – present: Computer Scientist, Applied Research Computing, United States Geological Survey, Denver, CO

October 2013 – November 2015: Lead IT Specialist, Applied Research Computing, United States Geological Survey, Denver, CO

April 2008 – October 2013: IT Specialist (Senior Systems Administrator), United States Geological Survey. Denver, CO

August 2007 – April 2008: Senior Systems Administrator contracted to United States Geological Survey, Isys Technologies, Denver, CO

October 2005 – August 2007: Senior Unix Systems Administrator contracted to Bureau of Land Management, Denver, CO

August 2001 – October 2005: Unix Systems Administrator, Jefferson County Colorado Government, Golden, CO

Publications:

2015

Stanislawski, Lawrence V., Jeff Falgout, and Barbara P. Buttenfield. “Automated Extraction of Natural Drainage Density Patterns for the Conterminous United States through High–Performance Computing.” The Cartographic Journal 52, no. 2 (May 2015): 185–92. http://dx.doi.org/10.1080/00087041.2015.1119466.

Wendel, Jeffrey, Michael P. Finn, John Kosovich, Jeff Falgout, and Yan Liu (2015) A solution for processing large files in the LASer (LAS) format using the message passing interface (MPI) and parallel file systems. In Proceedings 27th International Cartographic Conference Pre-conference workshop on Spatial data infrastructures, standards, open source and open data for geospatial (SDI-Open 2015), Serena Coetzee, Silvana Camboim, Antony K Cooper, Suchith Anand, Trevor Taylor, Rogerio Borba, Julia Strauch (Editors). ISBN 978-1-77592-117-2.

Conference Presentations:

2015

Hawbaker, T., R. Bosshart, S. Stitt, Y. Beal, J. Falgout, B. Williams, and J. Takacs. “Automated mapping of burned areas in Landsat imagery; tracking spatial and temporal patterns of burned areas in the southwestern United States.” AFE Fire Ecology and Management Congress. 16-20 November 2015, San Antonio, TX, USA

2014

Hawbaker, Todd J., Susan Stitt, Yen-Ju Beal, Gail Schmidt, Jeff Falgout, Carol Mladinich, Nicole Brunner, Megan Caldwell, Robert Bosshart, Josh Takacs, and Jodi Rieglea. “An automated approach to identify burned areas in Landsat imagery.” ISPRS Technical Commission I Symposium, Sustaining Land Imaging: UAVs to Satellites. 17–20 November 2014, Denver, CO, USA.

2013

Frame, Michael T., Falgout, Jeff T., Palanisamy, Giri. High-Performance Computing Cooperative in Support of Inter-Disciplinary Research at the U.S. Geological Survey (USGS): presented at The Geological Society of America Annual Meeting. 27–30 October 2013. Denver, CO.

Professional Associations:

Association for Computing Machinery (ACM), including the HPC Special Interest Group
League of Professional System Administrators (LOPSA), Charter Member
Rocky Mountain Advanced Computing Consortium (RMACC), Executive Committee Member

DANA M. INFANTE

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CURRENT POSITION

Associate Professor. Department of Fisheries and Wildlife, Michigan State University, East Lansing, Michigan. January 2007 to present.

EDUCATION

Doctor of Philosophy. 2005. Resource Ecology and Management, School of Natural Resources and Environment, University of Michigan, Ann Arbor, Michigan.

Master of Science. 2001. Resource Ecology and Management, School of Natural Resources and Environment, University of Michigan. University of Michigan, Ann Arbor, Michigan

Bachelor of Science. 1994. Scientific Writing, College of Literature, Science, and Arts, University of Michigan, Ann Arbor, Michigan.

RELEVANT PEER-REVIEWED PUBLICATIONS

Cooper, A. R., D. M. Infante, K. Wehrly, L. Wang, and T. Brendan. 2016. Understanding large-scale dam influences on fishes: Identifying indicators and quantifying effects. Ecological Indicators 61:646-657.

Wieferich, D., W. M. Daniel, and D. M. Infante. 2015. Enhancing the utility of the NHDPlus river coverage in the conterminous United States: Characterizing ecological river reaches for improved management and summary of information. Fisheries 40:562-564.

Daniel, W. M., D. M. Infante, R. M. Hughes, P. C. Esselman, Y. P. Tsang, D. Wieferich, K. Herreman, A. R. Cooper, L. Wang, and William W. Taylor. 2015. Coal and mineral mines as a regional source of stress to stream fish assemblages. Ecological Indicators 50:50-61.

Smith, S. D. P., P. B. McIntyre, B. S. Halpern, R. M. Cooke, A. L. Marino, G. L. Boyer, A. Buchsbaum, G. .A. Burton Jr., L. M. Campbell, J. H. Ciborowski, P. J. Doran, D. M. Infante, L. B. Johnson, J. G. Read, J. B. Rose, E. S. Rutherford, A. D. Steinman, and J. D. Allan. 2015. Rating impacts in a multi-stressor world: a quantitative assessment of 50 stressors affecting the Great Lakes. Ecological Applications 25:717-728.

Wang, L., C. M. Riseng, L. A. Mason, K. E. Wehrly, E. S. Rutherford, J. E. McKenna, C. Castiglione, L. Johnson, D. M. Infante, S. Sowa, M. Robertson, J. Schaeffer, M. Khoury, J. Gaiot, T. Hollenhorst, C. Brooks, and M. Coscarelli. 2015. A spatial classification and database for management, research, and policy making: The Great Lakes Aquatic Habitat Framework. Journal of Great Lakes Research 41:2.

Deweber, J. T., Y. P. Tsang, D. Krueger, J. B. Whittier, T. Wagner, D. M. Infante, and G. Whelan. 2014. Importance of understanding landscape biases in USGS gage locations: Implications and solutions for managers. Fisheries 39:4.

Allan, J. D., P.B. McIntyre, S.D.P. Smith, B.S. Halpern, G. Boyer, A. Buchsbaum, A. Burton, L. Campbell, L. Chadderton, J. Ciborowski, P. Doran, T. Eder**,** D.M. Infante, L.B. Johnson, C.G. Joseph, A.L. Marino, A. Prusevich, J. Read, J. Rose, E. Rutherford, S. Sowa, and A. Steinman. 2013. Joint analysis of stressors and ecosystems services to enhance restoration effectiveness. Proceedings of the National Academy of Sciences 110:372-377.

Esselman, P.C., D. M. Infante, L. Wang, A. Cooper, D. Wieferich, Y. P. Tsang, D. Thornbrugh, and W. W. Taylor. 2013. Regional fish community indicators of ecological condition for rivers of the conterminous United States. Ecological Indicators 26:163-173.

Januchowski-Hartley, S. R., P. B. McIntyre, M. Diebel, P. Doran, D. M. Infante, C. Joseph, and J. D. Allan. 2013. Restoring aquatic ecosystem connectivity requires inventories of both dams and road crossings. Frontiers in Ecology and the Environment 11:211-217.

Esselman, P. C., D. M. Infante, L. Wang, D. Wu, A. Cooper, and W. W. Taylor. 2011. An initial assessment of integrated landscape disturbance on river fish habitats in the conterminous United States. Restoration Ecology 23:133-151.

RECENT GRANTS

Gulf Coast Prairie Landscape Conservation Cooperative. Strategic coordination of Quadrula spp. research and conservation $59,915 (Dana M. Infante, lead, and Wesley M. Daniel).

U.S. Fish and Wildlife Service, National Fish Habitat Partnership. 2013-2018. A national assessment of the status of fish habitat. $477,750 (Dana M. Infante, lead, and William W. Taylor).

U.S. Geological Survey, Aquatic GAP Analysis Program. 2014-2016. Aquatic GAP Analysis Program: Enhancing data and approaches of the Nation's inland and coastal aquatic ecosystems. $257,469 (Dana M. Infante, lead).

International Joint Commission. 2015. Great Lakes Basin land cover and fragmentation status assessment. $12,000 pending (Dana M. Infante, lead).

International Joint Commission 2015. Assessment of progress indicator data integration. $80,100 pending (Brian Roth, lead, and Dana M. Infante).

Great Lakes Fishery Commission. 2015. Trade-offs for sea lamprey management using an operating model of the control program. $73,838 (Michael Jones, lead and Dana M. Infante).

Michigan Department of Natural Resources. 2014-2015. Characterizing spatial and temporal heterogeneity of coastal fish diversity. $19,927 (Brian Roth, lead, and Dana M. Infante).

Association of Fish and Wildlife Agencies. 2014. Developing a decision support process to aid in conservation of aquatic habitats throughout the Main Hawaiian Islands. $9226 (Dana M. Infante, lead).

Northeast Climate Science Center. 2012-2013. A stream temperature inventory network and decision support metadata mapper - Evaluating the resources to understanding climate change effects on streams in New England and the Great Lakes States. $134,800 (Jana Stewart, lead, Marcus Waldron, David Armstrong, Jim McKenna, **Dana M. Infante**, and Kevin Wehrly).

Subcontract: U.S. Geological Survey, Wisconsin Water Science Center. 2012-2013. A stream temperature inventory network and decision support metadata mapper - Evaluating the resources to understanding climate change effects on streams in New England and the Great Lakes States. **$13,000** (**Dana M. Infante**, lead).

SCOTT G. LEIBOWITZ

US EPA, 200 SW 35th Street, Corvallis, OR 97333
(541) 754-4508; leibowitz.scott@epa.gov

Education:

Ph.D. Marine Sciences (Electrical and Computer Engineering minor), Louisiana State University, May 1989.
M.S. Environmental Engineering Sciences, University of Florida, Dec. 1980
B.S. Agriculture and Life Sciences (with honors), Cornell University, May 1978

Title, Series, Grade and Step:

Research Ecologist, GS-0408-14-07 (GS-15 promotion approved but not finalized)

Recent Professional Employment:

8/12–present: Task Leader, US EPA National Health and Environmental Effects Research Laboratory (NHEERL), Western Ecology Division (WED). Lead for two tasks under the Air, Climate, and Energy and Safe and Sustainable Water Resources [SSWR] Programs

3/06–7/12: Principal Investigator (PI), Non-navigable Streams and Wetlands Project, US EPA NHEERL/WED

1/01–9/07: PI, Freshwater Habitat Project, US EPA NHEERL/WED

Major Honors and Awards:

Co-PI for Powell Center working group on "North American Analysis and Synthesis on the Connectivity of 'Geographically Isolated Wetlands' to Downstream Waters". Oct. 1, 2014.

2013 Honor Award for Exceptional/Outstanding ORD Technical Assistance to the Regions or Program Offices: Geographically Isolated Wetlands Research Team. Sept. 25, 2014.

EPA Bronze Medal for establishing how the configuration of habitats in stream networks impact the productivity and survivability of coho salmon. July 8, 2010.

EPA's 2004 Level 1 Scientific and Technological Achievement Award for research publication advancing the scientific understanding of isolated wetlands. May 16, 2005.

EPA Bronze Medal for outstanding achievement of the Wetlands Research Team for contributing to a wetlands protection strategy and wetlands ecology. Feb. 14, 1992.

Professional Service and Recognition:

Associate editor for *Journal of the American Water Resources Association* (Mar. 2015 – present) and *Wetlands* (Jan. 2009 – Mar. 2015).

Technical lead for two chapters (conceptual framework and wetlands) in EPA's *Connectivity* report, which was the technical basis for the recent Clean Water Rule (Aug. 2010 – Jan. 2015)
Co-lead of the Hydrology Subgroup at the Isolated Wetlands Research Workshop, Joseph W. Jones Ecological Research Center, Newton, GA, November 18-21, 2013

Recent Peer Reviewed Journal Articles:

Cohen, M.J., I.F. Creed, L.C. Alexander, N.B. Basu, A.J.K. Calhoun, C.B. Craft, E. D'Amico, E.S. DeKeyser, L.A. Fowler, H.E. Golden, J.W. Jawitz, P. Kalla, L.K. Kirkman, C.R. Lane, M.W. Lang, **S.G. Leibowitz**, D.B. Lewis, J.M. Marton, D.L. McLaughlin, D.M. Mushet, H. Raanan-Kiperwas, M.C. Rains, L.L. Smith, and S.C. Walls. Do geographically isolated wetlands influence landscape functions? *Proceedings of the National Academy of Sciences* (in press).

Faulkner, B.R. **S.G. Leibowitz**, T.J. Canfield, and J.F. Groves. Quantifying groundwater dependency of riparian surface hydrologic features using the exit gradient. *Hydrological Processes* (in press).

Leibowitz, S.G., R.L. Comeleo, P.J. Wigington, Jr, M.H. Weber, E.A. Sproles, and K.A. Sawicz. Hydrologic landscape characterization for the Pacific Northwest, USA. *Journal of the American Water Resources Association* (in press).

Rains, M.C., **S.G. Leibowitz**, M.J. Cohen, I.F. Creed, H.E. Golden, J.W. Jawitz, P. Kalla, C.L. Lane, M.W. Lang, and D.L. McLaughlin. 2016. Geographically isolated wetlands are part of the hydrological landscape. *Hydrological Processes* 30:153-160 (invited commentary).

Ebersole J.L., P.J. Wigington, Jr., **S.G. Leibowitz**, R.L. Comeleo, and J. Van Sickle. 2015. Predicting the occurrence of cold-water patches at intermittent and ephemeral tributary confluences with warm rivers. *Freshwater Science* 34(1):111-124.

Flotemersch, J.E., **S.G. Leibowitz**, R.A. Hill, J.L. Stoddard, M.C. Thoms and R.E. Tharme. 2015. A watershed integrity definition and assessment approach to support strategic management of watersheds. *River Research and Applications* DOI: 10.1002/rra.2978.

Fullerton, A.H., C.E. Torgersen, J.J. Lawler, R.N. Faux, E.A. Steel, T.J. Beechie, J.L. Ebersole, and **S.G. Leibowitz.** 2015. Rethinking the longitudinal stream temperature paradigm: region-wide comparison of thermal infrared imagery reveals unexpected complexity of river temperatures. *Hydrological Processes* 29:4719-4737.

Hill, R.A., M.H. Weber, **S.G. Leibowitz**, AR. Olsen, and DJ. Thornbrugh. 2015. The Stream-Catchment (StreamCat) Dataset: A database of watershed metrics for the conterminous USA. *Journal of the American Water Resources Association* DOI: 10.1111/1752-1688.12372.

Leibowitz, S.G. 2015. Geographically isolated wetlands: why we should keep the term. *Wetlands* 35:997-1003.

Nadeau, T.-L., **S.G. Leibowitz**, P.J. Wigington, Jr., J.L. Ebersole, K.M. Fritz, R.A. Coulombe, R.L. Comeleo, and K.A. Blocksom. 2015. Validation of rapid assessment methods to determine streamflow duration classes in the Pacific Northwest. *Environmental Management* 56:34–53.

Sproles, E.A., **S.G. Leibowitz**, J.T. Reager, P.J. Wigington, Jr., J.S. Famiglietti, and S.D. Patil. 2015. GRACE storage-runoff hystereses reveal the dynamics of regional watersheds. *Hydrology and Earth System Sciences* 19:3253-3272.

Marc H. Weber

US EPA, 200 SW 35th Street, Corvallis, OR 97333
(541) 754-4469; weber.marc@epa.gov

Education:

M.S. Geography, Portland State University, June 2001
B.A. English / Environmental Studies, University of Oregon, June 1992

Title, Series, Grade and Step:

Biologist, GS-0401 (GS-12)

Professional Employment:

08/08–present: Spatial Analyst, US EPA National Health and Environmental Effects Research Laboratory (NHEERL), Western Ecology Division (WED). Perform spatial analysis for EPA National Aquatic Resource Surveys (NARS) and in support of national predictive modeling of watershed integrity and stream condition.

12/05–08/08: GIS Specialist, USFS Rocky Mountain Research Station Fire Sciences Lab. Performed GIS analysis and programming support for the USFS LANDFIRE program and fire and landscape simulation models (LANDSUM, VDDT).

04/03–12/05: Biologist, USFS Rocky Mountain Research Station Fire Sciences Lab. Provided field, GIS, and data management support for research project examining historical fire regimes in Utah.

06/01–03/03: Ecologist, USFS Pacific Northwest Research Station Forestry Sciences Lab. Supervised field crew for the Forest Inventory and Analysis Program (FIA), performed database development and performed map production and spatial analysis using GIS software.

Honors and Awards:

2012 US EPA Western Ecology Division Certificate of Merit.

2010 EPA Bronze Medal for commendable service to the EPA Office of Water.

2009 US EPA Outstanding Technical Assistance Award for work with the Office of Research and Development National Lakes Assessment.

2007 USFS Extra Effort Award for presentations to LANDFIRE external review committee.

Professional Memberships:

International Association for Landscape Ecology

Selected Peer-Reviewed Journal Articles:

Leibowitz, S.G., R.L. Comeleo, P.J. Wigington, Jr, **M.H. Weber**, E.A. Sproles, and K.A. Sawicz. Hydrologic landscape characterization for the Pacific Northwest, USA. *Journal of the American Water Resources Association* (in press).

Hill, R.A., **M.H. Weber**, S.G. Leibowitz, AR. Olsen, and DJ. Thornbrugh. 2015. The Stream-Catchment (StreamCat) Dataset: A database of watershed metrics for the conterminous USA. *Journal of the American Water Resources Association* DOI: 10.1111/1752-1688.12372.

Xue, J., V. Zartarian, B. Mintz, **M.H. Weber**, K. Bailey, A. Geller. 2015. Modelling tribal exposures to methyl mercury from fish consumption. *Sci. Total Environ.* 533:102-109.

Payton, Q.C., M.G. McManus, **M.H. Weber**, A.R. Olsen, T.M. Kincaid. 2015. micromap: a package for linked micromaps. *Journal of Statistical Software.* 16(2):1-16.

Brooks, J.R., J.J. Gibson, S.J. Birks, **M.H. Weber**, J.L. Stoddard. 2014. Stable isotope estimates of evaporation: inflow and water residence time for lakes across the United States as a tool for national lake water quality assessments. *Limnology and oceanography.* 59(6):2150-2165.

Peck, D.V., A.R. Olsen, **M.H. Weber**, S.G. Paulsen, C. Peterson, S.M. Holdsworth. 2013. Survey design and extent estimates for the National Lakes Assessment. *Freshwater Science.* 32(4):1231-1245.

Selected Professional Presentations:

Research Triangle Park, NC. Invited Conference Panelist. *EPA Integrating Environmental and Information Sciences Workshop.* 'Practitioners Panel'. October 2015.

Washington, D.C. Invited Presenter. *EPA GIS Workgroup Annual Meeting.* 'Using R For Spatial Analysis'. March 2014.

Washington, D.C. Presenter. *The National Water Quality Monitoring Conference.* 'Creating the Spatial Framework for National Aquatic Resource Surveys'. April 2012.

Brad Williams
Computer Scientist
Contracted to: Applied Research Computing
Core Science Analytics, Synthesis, and Libraries
U.S. Geological Survey

Education

Bachelor of Science: Computer Science, 2000
Colorado State University, Fort Collins, CO

Work Experience

Computer Scientist, 2013 – Present
Contractor to: Applied Research Computing; Core Science Analytics, Synthesis, and Libraries; U.S. Geological Survey, Denver, CO

Technical advisor on parallel software development including use of MPI. Software analysis and optimization of scientific models with an emphasis on performance and scalability. Data visualization of scientific datasets to enable visual analysis. Developed training materials and examples for HPC courses.

Configuration and maintenance of supercomputing cluster, including the SLURM job scheduler. Compiling software packages and creation of module files for the Supercomputing cluster. Puppet Modules / Razor Templates for automated configuration of Supercomputing cluster. Custom reporting toolkit and statistical usage analysis charts.

DevOps / System Administration, 2011 – 2015
Contractor to: Applied Research Computing; Core Science Analytics, Synthesis, and Libraries; U.S. Geological Survey, Denver, CO

Lead Software Engineer / Release Engineer, 2004 – 2011
Contracted to: USGS Center for Biological Informatics / National Biological Information Infrastructure, Denver, CO

Software Development Engineer, 2003 – 2004
Sun Microsystems Inc., Broomfield, CO

Build and Release Engineer, 2001 - 2003
Sun Microsystems Inc., Broomfield, CO

Conference Presentations:

Hawbaker, T., R. Bosshart, S. Stitt, Y. Beal, J. Falgout, B. Williams, and J. Takacs.
"Automated mapping of burned areas in Landsat imagery; tracking spatial and temporal patterns of burned areas in the southwestern United States." AFE Fire Ecology and Management Congress. 16-20 November 2015, San Antonio, TX, USA

Workshops

2015
Instructor, Scientific Computing Workshop, HPC 101
Applied Research Computing, U.S. Geological Survey

2014
Instructor, Scientific Computing Workshop, HPC 101
Applied Research Computing, U.S. Geological Survey

2013
Attended, SC13 Supercomputing Conference Tutorials

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Washington, DC 20002
Tel: 202/ 838-3474 ♦ F: 202/ 350-9869
Web www.fishhabitat.org

January 21, 2016

To: Community for Data Integration Proposal Evaluation Committee

Re: National Stream Summarization Study
Support Letter

Dear colleagues,

The Co-chairs of the National Fish Habitat Partnership Science and Data Committee have completed their review of the USGS Community for Data Integration proposal entitled: "National Stream Summarization: Standardized Stream-Landscape Summaries". Based on their review, the National Fish Habitat Partnership Board wishes to express its support for this well written and designed proposal. This proposal will further the efforts for a broad community of investigators wrestling with regional and national scale analyses and modeling of aquatic systems. The output of this effort, a common NHD-linked USGS/EPA/NFHP dataset of local- and network-scale characteristics, will serve as a foundation for the 2020 NFHP habitat assessment and will support many other uses as well.

A key and very valuable component of this this proposal is establishing a repeatable standardized workflow and collaborative framework that can be re-used and evolved to meet future needs as well. This moves the current efforts from a single database product to a much more adaptive environment which we strongly support.

Given our knowledge of the principle investigators and collaborating partners, we have full confidence that they will be fully capable of successfully completing this project. We strongly support the production of the products as outlined in this proposal and request that this project be given full consideration for funding. If you have any questions on this matter, please contact me.

Sincerely,

Peter Ruhl, Biological Data Manager, U.S. Geological Survey Office of Water Quality
pmruhl@usgs.gov
703-943-0063 (m)
703-648-6841 (o)

Gary Whelan, Program Manager, Michigan Department of Natural Resources - Fisheries Division
whelang@michigan.gov
517-284-5840